A standardized health services framework for developing digital health tools

Leveraging a human-centric design approach

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>> Setting the context

There has been continuous effort in digitalizing health service delivery in public health care facilities. Despite the existence of global, national, and regional strategies and guidelines that inform health care delivery processes and functions, there is a lack of consistency and standardization between health programs across national- and state-level platforms. This lack of standardized practices is evident from both the perspectives of care seekers and the health workforce across various communities and health facility levels. This is why the design, development, and implementation of digital health solutions frequently fall short of incorporating values such as diversity, equity, inclusion, citizen-centricity, and a community-first approach.

Consequently, stakeholders in the digital health ecosystem do not have a consistent programmatic and systemic perspective, nor a decentralized specification of service flows to draw upon. When a digital solution company, government entity, or private sector organization begins to develop a tool, innovation, intervention, or platform for public health care, it frequently reinvents the wheel by returning to the fundamental mapping of the proposed workflows or program-specific requirements, which often operate in isolated silos. This deviation from a holistic health care service delivery method exacerbates the problem. Additionally, the design of many digital solutions and data-mapping efforts often lack standardized approaches, reducing their focus on user-centricity. Most solutions are developed according to specific health program guidelines, leading to vertical, program-specific digital tools rather than addressing the broader health care ecosystem.

To address the identified challenges, this project aims to initiate a foundational design process. This includes mapping the health service delivery workflows for care seekers across the continuum of primary health care, with linkages to the point of care, service provider, and public health programs. By thoroughly mapping these workflows, the project envisages to co-design a consistent and standardized framework for digital solution providers, which will serve as a ready reckoner in developing digital tools in health care.

This framework, validated through expert consultations and use cases, will provide the digital solution developers with a standardized domain-agnostic format for developing digital solutions for primary health care service delivery. Based on the framework facets, an Excel-based compendium of three health thematic areas will be developed, containing information on health care services, providers, and national-level programs relevant to each thematic area. Additionally, the framework and compendium will be converted into a user-friendly tool for health care digital solution developers, serving as a ready reference to navigate the health service delivery landscape.





» Key Objectives



Develop a standardized framework for the primary health care service delivery ecosystem to guide the creation of digital solutions. This will include a compendium detailing of health care services, primary health care providers, and national health programs.

Develop an intuitive, end-user digital tool based on the framework and compendium for RMNCH+A, NCDs, and MH within the primary health care service delivery ecosystem.

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Deploy the validated framework to test three health thematic areas:

- reproductive, maternal, newborn, child health plus adolescents (RMNCH+A);
- non-communicable diseases (NCDs); and
- mental health (MH).



Demonstrate and disseminate the framework and tool to relevant stakeholders.

Scope of Work

- To design and develop the standardized framework, the project mapped program/disease-based health care services to the primary health care level, focusing on services provided up to the primary health care center health and wellness center (PHC-HWC), as per the threetier public health service delivery system.
- Only national-level operational guidelines and protocols were considered for developing the framework, excluding state-issued guidelines to ensure uniformity and applicability across the country.
 - For validating and standardizing the framework, three health thematic areas—RMNCH+A, NCDs, and MH were selected. These areas were chosen based on their alignment with Sustainable Development Goal (SDG) priorities and the significant morbidity and mortality burdens they represent, requiring immediate nationallevel attention.

Methodology and implementation

The standardized framework for digital health solution providers was developed using an agile and iterative methodology. The principles of a human-centric design (HCD) as reflected in Figure 1 were applied to identify the problem and arrive at the solution. The first step involved identifying the needs of the digital solution developers, particularly in understanding the primary health care service landscape before tool development. Ideas and insights for the framework were gathered through a literature review and stakeholder consultations. These insights were then analyzed to define the key themes and facets of the framework. The process continued with designing, testing, and gathering feedback from stakeholders, including expert groups, followed by iterative refinements (see Annexure A).

Using a humancentered design approach to co-create solutions with users to solve their most pressing challenges.



DISCOVER

1

Understand the context and user needs by reviewing the literature and stakeholder consultation

2 DEFINE

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Analyze the learnings and insights, and arrive at a possible solution •



3 DESIGN

Develop the framework, test, gather feedback and iterate



4 DREAM

Validate through use cases, modify and roll out



The following sections describe the key activities undertaken to develop the theme-agnostic health framework and Excel-based compendium of health care services landscape.

Desk research and literature review

The purpose of this activity was to gather comprehensive information on the primary health service delivery landscape and document all aspects of public health service delivery, such as service delivery points, health care providers, and service packages. This activity also mapped the national-level programs rolled out for each health thematic area. The aim of this activity was to consolidate information on the selected thematic areas across numerous national-level guidelines, protocols, and standards.

As a first step, desk research was conducted to review government guidelines, protocols, and other relevant documents available on the websites of the Indian government and nationaland state-level health departments. Additional documents were sourced from the website of the World Health Organization (WHO) and published peer-reviewed articles available in the public domain. A free-text search was also undertaken to collect information from online sources. The key inclusion criteria for the literature review were national guidelines relevant to the health thematic areas, with a focus on primary health care service delivery in India. Documents referred to for literature review are listed in Annexure B.



Stakeholder engagement

The aim of this activity was two-fold. First, on-site visits to primary health facilities were conducted to validate the information gathered from secondary literature on the primary health service landscape. Second, semi-structured interviews and small group discussions were held to understand the care continuum journey and identify challenges and potential solutions.

To undertake this task, the project team visited four states of India: Assam, Madhya Pradesh, Meghalaya, and Odisha. In addition to primary health care facilities, the team also visited community health centers and district hospitals to gain a deeper understanding of the referral and back-referral chains within the health system. Stakeholder discussions were conducted to gain insights from health care seekers and health service providers in these facilities. The discussions helped the team understand the challenges faced and come up with potential solutions to them.

Interviews and group discussions were also conducted with digital solution providers, who are the key stakeholders of this project. This was undertaken to understand their comprehension of public health interventions and the challenges they face while developing digital tools for primary health care services.



Analyzing insights from literature review and stakeholder engagement

The aim of this activity was to develop a potential solution for digital solution developers. To achieve this, the ideas and insights gathered in previous steps were classified, and an internal discussion within the project team was undertaken to analyze the patterns. Key issues were identified, listed, and shared with experts for consultation.

One key issue that emerged from this analysis is that digital solution providers often have limited knowledge of public health systems, making it challenging to assimilate the vast expanse of health thematic area-wise information. Besides, the multiple iterations required to finalize data points make the process cumbersome.

It was inferred that the digital solution developers would benefit if a theme-agnostic standardized health framework was developed, which provides the details of the care journey in a primary health setting, as well as identifies health care providers and associated care packages. This framework would guide developers on which data points to focus on while creating digital tools for health care. Besides, a standardized framework would ensure that information collection is streamlined, accurate, and consistent. A detailed description of stakeholder engagement and insights from the discussions is provided in Annexure C.



Developing the standardized health service framework



The purpose of developing a theme-agnostic health framework is to provide a broad map to digital health solution providers, so they can understand the journey of care in India's primary health care setting. It also intended to provide information on associated components in service delivery, such as details of clinical and non-clinical health care providers like accredited social health activists (ASHAs) and auxiliary nurse midwives (ANMs); national health programs like the Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA), a protocol for managing high-risk pregnant women; and points of care like community and primary health care center HWCs. By using this framework, the digital solution provider will not have to refer to multiple documents while developing a digital solution for primary health care.

The following section describes in detail the process of developing the framework.



Mapping and identifying the facets for the framework:

- From the desk research, documents related to various health thematic areas were collected, and information was compiled under broad headings representing multiple facets, elements, and stages of health care service delivery.
- Human resources, both providing clinical and non-clinical health services, were also listed. Subsequently, the national-level health programs associated with each thematic area were mentioned under the thematic and sub-thematic areas.
- Various aspects of primary health care service delivery were identified and mapped using the national-level operational guidelines and protocols. These were further corroborated through field visits.



Classifying the facets and standardizing the nomenclature:

- The mapping exercise brought out several sub-thematic areas, which required consolidating and organizing under the appropriate thematic area.
- The health service delivery aspect within each thematic area was either unique or similar to other sub-thematic areas, and hence required arranging appropriately.
- Moreover, the nomenclature provided in the documents varied and necessitated an appropriate and standardized categorization.
- The categorization was done under various headings in all sub-thematic areas. Similar service delivery aspects such as laboratory tests were grouped into service delivery types and the specific element under these types were further grouped into components. After a certain point of distillation, only unique values remained. These were either named as component or sub-component under a given service delivery type. To capture the minutest detail of the topic, these unique values were not generalized into any more categories.
- Any broad categorization done at the previous level was relooked and a second level of recategorization was undertaken to streamline and make it uniform across all the thematic areas for the project's framework.



Developing a thematic map to show linkages between various facets:

- A thematic map was created after organizing and categorizing information using standardized nomenclature such as the sub-thematic area, service delivery, details of health care providers, care packages, and national health programs.
- The thematic map was designed to highlight the relationships between distinct features within the greater context of thematic and sub-thematic areas, forming the basis for the standardized framework.



Developing the Excel-based compendium

- The goal was to create a ready reckoner that consolidates the primary health care service delivery landscape across each thematic area and population cohort. The compendium serves as a uniform reference, allowing for easy visualization and navigation in a single window, thus eliminating the need to consult multiple health guidelines.
- Once the framework was developed, information on three selected health thematic areas—RMNCH+A, NCDs, and MH—was collected, analyzed for errors and discrepancies, and organized using Excel sheets.

Validating the framework and the Excel-based compendium The aim of these discussions was to gather feedback, refine both the framework and the compendium, and ensure the continuous evolution of the entire package.

The framework was shared with key stakeholders, including digital solution developers and the public health development community, to assess their understanding and gather feedback on its design and various components. Consultation meetings were conducted at both state and national levels with government stakeholders, such as the National Health Mission (NHM), National Health Systems Resource Centre (NHSRC), private sector entities, and domain experts from various health thematic areas across public health development partners and digital health solution providers.

These stakeholders provided valuable insights that were instrumental in refining the framework to enhance its relevance and effectiveness. Feedback was compiled for consideration in refining both the framework and the compendium. This validation process helped to solidify the framework's applicability and utility in guiding future digital health interventions. A list of consulted stakeholders, along with key feedback, is provided in Annexure D.

Deploying the framework to further validate functionality

As a final step for validating the framework and systematically mapping each facet in chronological order, three use cases were undertaken for RMNCH+A, NCDs, and MH. This process allowed for the testing and application of the framework's components and provided feedback for ongoing refinement and optimization of the tool.

>> Project output

The project outputs include a standardized primary health service delivery framework, an Excel-based compendium of health services, and an end-user tool.

Standardized primary health service delivery framework

This adaptable framework is designed to provide a comprehensive understanding of public health service delivery mechanisms by systematically mapping all the services and components associated with public health service provision. It can be applied across various thematic areas-such as communicable diseases, vectorborne diseases, and other public health priorities-by organizing programmatic guidelines under the specific headings and facets identified within the framework. The framework can be used to create detailed mappings that help stakeholders visualize how different services are interlinked and how program guidelines are implemented across various levels of care.

The framework is envisioned as a universal tool that can be expanded to map service delivery models across various health thematic areas in the future. This approach not only deepens the understanding of current service delivery models but also helps identify gaps, overlaps, and opportunities for improvement.

This framework is designed to ensure a comprehensive, structured, and systematic approach to viewing the health care delivery landscape. By following this framework, health systems can ensure that every level of health care delivery is well-defined and equipped to provide the necessary care to the target population.

The framework has nine distinct and two overlapping facets, and the definition of each facet in the framework is provided below, along with some examples: Health thematic area: It is the broader health care thematic areas, such as RMNCH+A, NCDs, and MH, under which health care packages are categorized.

Sub-thematic area: It is the specific area of interest under the health thematic area, for which specific services are provided (e.g., maternal health under RMNCH+A, diabetes under NCDs, and common mental disorders under MH).

Population cohort: These are health care seekers, beneficiaries, or clients who are provided and/or who seek health services from the public health service delivery system. A population cohort is usually defined by similar characteristics, such as a stage of pregnancy or an age group that may also require special attention and care (e.g., pregnant women and neonates).

Care package: These are a series of services that are to be provided at a given level of care in public health service delivery under the Comprehensive Primary Health Care (CPHC) for a sub-thematic area or thematic area (e.g., antenatal care in pregnancy and childbirth for maternal health under RMNCH+A).

Point-of-service delivery: This refers to the specific level or location where health services and care are provided, as mandated by the public health system e.g., sub-center - health and wellness center (SC-HWC) and primary health care centers - health and wellness center (PHC-HWC) for the primary care level. In many cases, the point of service delivery has a designated health workforce (e.g., an ANM at SC-HWC). The point of service delivery may also expand to non-health facilities when service delivery is being provided in outreach mode (e.g., a public school in cases where camps are being organized or when counselling is being provided at the school level).



Government programs: National health programs rolled out by the Government of India, laying down targets and implementation procedures to mitigate population health challenges and/or cater to the health and well-being needs of specific population cohorts. For instance, Surakshit Matritva Aashwasan (SUMAN) is an initiative that focuses on assured delivery of maternal and newborn health care services encompassing wider access to free, and quality services, and assured management of complications.

Service provider: Health workforce or human resources for health who provide clinical and non-clinical health services to the population (e.g., ANMs and medical officer); professionals who assume the role of providers to enable health and well-being of certain population cohorts (e.g., anganwadi workers while providing care to malnourished children or schoolteachers while providing care to school-going adolescents).

Service delivery: These are a set of integrated health services or packages delivered across the continuum of care to all population cohorts specific to their needs, such as First Antenatal Care Package (ANC1) for pregnant woman.

- Service delivery type: A cluster of similar services provided to the beneficiaries, patients, and clients (e.g., laboratory examination, general examination, or counselling under ANC1).
- Service component: Specific services that are being provided under the defined service type (e.g., obstetrics history under history taking of the health care seeker).
- Service subcomponent: Subset of the service component defining or expanding on the specific service component (e.g., recurrent early abortions under obstetrics history).

Classification: A specific condition or outcome value of the component or the sub-component that requires further clinical and/ or public health intervention (e.g., a severely anemic pregnant woman (hemoglobin < 7) is classified as high-risk pregnancy).

Protocol: Standardized measures to be undertaken for a given classification as defined by Government of India guidelines (e.g., if a pregnant woman is classified as high-risk pregnancy, as per the guidelines, then the PMSMA protocol is to be followed, which entails further referral and a set of more interventions either at the same facility or at a higher-level health facility).

Use cases for validating the framework

To further validate and systematically map each facet of the tool, use cases were created by deploying it across three thematic areas—RMNCH+A, NCDs, and MH. By applying the framework, its versatility and effectiveness were assessed, demonstrating its ability to explain service delivery workflows and link relevant stakeholders across each thematic area. This process also provided feedback for refining and optimizing the tool to enhance its functionality and adaptability.

The process begins by identifying thematic areas, such as RMNCH+A, followed by sub-thematic areas that include maternal health, neonatal health, and more. Under each sub-thematic area, a care package is defined according to the CPHC guidelines, which outlines the range of services provided to each population group (e.g., pregnant women, newborns, and lactating mothers). These population cohorts are listed on the left side of the framework.

The corresponding government health programs linked to the thematic, sub-thematic areas, and care packages are shown on the right, such as Surakshit Matritva Aashwasan (SUMAN) and Janani Suraksha Yojna (JSY) in this case. Additionally, the point of service delivery (e.g., primary health centre, community health centre, and district hospital) and the service provider (e.g., ANM, staff nurse, medical officer) are represented on the left and right sides of the framework, respectively.



Figure 4. Detailed overview on how to read the framework using RMNCH+A as a use case.

Within the care package, specific services are delivered—such as the first antenatal check-up. This service includes various subsets, such as history taking, which can be broken down further into components and sub-components, like obstetrics history taking. In this instance, the sub-component would involve gathering information about recurrent early abortions in previous pregnancies. It is important to note that not all service components will have sub-components.

Based on the findings (e.g., the presence or absence of recurrent early abortions), the pregnant woman may be classified as a high-risk or non-high-risk pregnancy. This classification is then followed by the appropriate protocol, such as the PMMSA clinical protocol. The arrows in the framework indicate that classification and protocol can be linked directly to service components or sub-components without necessarily following a strict sequence. However, not every service component or subcomponent will lead to a classification or protocol. Other examples of use cases are provided in Annexure E.

Excel compendium

A compendium was developed based on the facets of the aforementioned framework. An Excel-based mapping of public health service delivery was conducted in depth across three thematic areas: RMNCH+A, NCDs, and Mental Health (Figure 5).

Health Thematic Area

Sub Thematic Area



Figure 5. A snapshot of the excel compendium for reference

This mapping includes available care packages, detailed descriptions of protocols, and a clear classification system to maintain consistency and effectiveness in health care provision. The inclusion of government programs and a focus on specific population cohorts ensures that health care services are targeted and adequately supported at various levels.

The resulting compendium serves as an organized reference manual for the services delivered within each thematic and sub-thematic area. It is designed for the digital solution developer community, ensuring that the information is both accessible and easily understood. Each data point, along with its description and type, is mapped to the corresponding service component and sub-component.

This comprehensive mapping supports the digital health community in capturing and utilizing uniform data formats, which is crucial for building interoperable applications. By providing a structured and detailed guide, the framework-based Excel mapping facilitates the development of digital health interventions that are consistent and aligned with public health objectives.

To access the compendium tools, scan the QR Code below





To access the tool, scan the QR Code



End-user's plug and play tool

Recognizing the potential for greater usability, the team also initiated the development of an automated digital tool designed as a ready reckoner for end users to visualize and navigate the service delivery landscape compiled in the Excel-based compendium. The primary aim of the digital end-user tool is to enable dynamic pivoting across the framework's facets, providing an easy and comprehensive visual representation of the information within the three thematic areas.

To facilitate its design and creation, a specialized external technical agency with expertise in software and digital application development was engaged. The team received detailed technical specifications and a reference wireframe, which served as a clear blueprint for development. This structured approach facilitated iterative improvements through feedback loops, ensuring the tool met the necessary requirements.

The plug-and-play end-user tool was developed based on the framework designed for digital interventions, as depicted above. This tool dynamically integrates multiple facets of the framework, offering both visual and functional elements that make it a one-stop schema diagram for understanding service delivery workflows in a digital format.

Visually, the tool presents a comprehensive view of health care service delivery, making it easier to grasp complex workflows. Functionally, it serves as a foundational design aid for digital system design teams, helping them create effective digital solutions and interventions. By leveraging this tool, developers can ensure that their designs align with established clinical guidelines and protocols, promoting consistency and accuracy in digital health applications.

Moreover, the tool is a valuable resource for policymakers and administrators, providing an easy reference that offers a detailed view of the service delivery landscape. It helps them understand how various services are organized and delivered across different thematic and sub-thematic areas, based on standard clinical guidelines and protocols. This comprehensive insight supports informed decision making and strategic planning in health care.

Overall, the tool's dynamic nature and plug-and-play capability make it an essential asset for both digital health developers and health care policymakers, bridging the gap between clinical guidelines and practical implementation in digital health solutions. The QR Code to browse the tool is attached below along with a set of technical specifications provides in Annexure F.

Demonstration and dissemination of the framework and end-user tool

As the final step in the project, the framework and end-user tool package, along with the Excel-based compendium of service delivery mapping across the three health thematic areas, were demonstrated to the experts and relevant stakeholders consulted during the validation phase. The demonstration involved explaining the various facets of the framework and the information available in the Excel-based compendium. This was followed by an overview of thematic area-wise care-seeking journey for population cohorts and the health care service delivery pathways of service providers. The demonstration also showcased the end-user digital tool, highlighting its features and functionalities.

This dissemination aimed to assess the tool's practical utility and potential for adoption within the health care ecosystem. Feedback from the stakeholders was crucial in understanding how the package could enhance the design of the digital health tool, streamline processes, and support broader implementation in health care settings. The insights and feedback gathered from these activities will be addressed and incorporated in the future versions of the framework and the enduser tool. Once the framework and the tool are in use, the project team will ensure orientation sessions for end-users to facilitate effective usage and troubleshooting of the tool.



Challenges and mitigation strategies

The development of a theme-agnostic health framework, along with the compilation of information for the compendium from various sources, presented several challenges. This process necessitated an extensive literature review, field visits for validation of collected information, expert consultations, and further validation efforts. Some of the challenges encountered during the project, along with the mitigation strategies employed by the team to overcome them are detailed below:

Development of the theme-agnostic health framework for the project: The expanse of health thematic areas and available literature presented significant challenges in identifying the key facets for the framework. Numerous guidelines and clinical protocols associated with each thematic area and population cohort complicated efficient navigation and referencing. The sheer volume of material was overwhelming, and the task of cross-referencing various documents became time-consuming.

To address this, the team undertook a structured literature search, reviewing documents from each health domain individually. The scope was subsequently narrowed to three health thematic areas for information collection and compilation. Once an initial framework was developed, it underwent further refinement through an iterative process that involved demonstrating the framework to experts, gathering feedback, and testing it through use cases.

Dispersed information on national health guidelines and standards: The project team faced the challenge of navigating multiple documents, as information on various health services and national-level programs stemmed from specific guidelines associated with each vertical program. Furthermore, these guidelines are updated irregularly, leading to confusion regarding the applicability of the latest information on the ground. To mitigate this issue, the team primarily focused on national guidelines and limited the scope of their analysis to three health thematic areas. They also validated the information gathered from literature through on-site visits.

In-depth knowledge of digital solution designing and development: Developing the design and wireframe for a plug-and-play end-user tool, along with implementing the envisioned solution, presented significant challenges. A key difficulty was ensuring that users and stakeholders could intuitively navigate the tool. The design process required careful consideration of user experience, balancing functionality with ease of use. Explaining the tool's features and guiding stakeholders on how to interact with the system added a layer of complexity. To develop an effective tool, the team initiated the design and development process using simple wireframes and understandable formats. They undertook extensive iterations and consultations with various stakeholders, followed by gathering feedback and revising materials to strike a balance between technical accuracy and usability.

Recommendations and conclusion

BUSINES

Digital health interventions and solutions play a key role in facilitating effective health care delivery, generating insights for promoting well-being, preventing and managing diseases, and making data-driven health program decisions. The design of these interventions relies on a thorough understanding of functional health workflows, data points, and the information that needs to be captured. However, as technologies continue to evolve, the challenge of accurately mapping workflows and ensuring proper data collection, categorization, presentation, and utilization grows. Hence, to support the digital health ecosystem, a standardized HCD framework for health service delivery mapping was proposed to be developed through this project.

This framework aimed to organize health care services systematically by ensuring a comprehensive approach that addresses different levels and aspects of health care delivery. Based on the advantages that the framework and tool have to offer, it is recommended that the themeagnostic health framework be integrated with national-level guidelines to ease the adaptability of these guidelines into digital solutions. However, it is acknowledged that since different states operate with distinct functional workflows and service delivery protocols, it is paramount that the framework has options to adopt and contextualize information to meet state-specific requirements.

The framework, along with the end-user tool, has versatile specifications that can be customized and scaled up in other countries. This would require adequate demonstration of the product, dissemination at appropriate platforms, and support for institutionalization at various levels. Digital health interventions are crucial for optimizing and strengthening health systems in order to produce improved health outcomes; yet, for them to be sustainable and effective, they must be designed and deployed in a comprehensive, country-led, and context-specific manner.

Annexures

Annexure A: Description of a human-centric design

Human-centric design (HCD) is a creative problem-solving approach that involves developing a deep understanding of the people for whom the design is being made. HCD helps the creators observe and empathize with the target users, learning directly from them to co-create solutions.

The project used for <u>PATH's 4D approach</u> for HCD as a reference to base the design of the service delivery framework (Figure A1).

Figure A1. PATH's 4Ds approach to a human-centric design.



The project's Human-Centered Design (HCD) approach aligns with the HCD principles outlined by the Ministry of Electronics and Information Technology (MeiTY), emphasizing the creation of digital services tailored to the needs, behaviors, and experiences of users. A summary of the key aspects of this approach is provided in Figure A2.

Figure A2. An adaptation of MeiTY's approach to a human-centric design .

Empathize

Understand the users: Conduct comprehensive user research, both primary and secondary, to gain insights into the diverse needs, challenges, and behaviors of different user groups, specifically digital solution developers and the public health community.

Define

Problem statement: Clearly define the problems and needs identified during the empathize phase. Map out the user journey to pinpoint pain points and opportunities for the use cases of the framework and tool.



Ideate

Co-creation and concept development: Conduct brainstorming sessions internally and with the users to generate a wide range of ideas and potential solutions. Develop initial concepts and prototypes based on the most promising ideas.

Prototype

Low-fidelity and high-fidelity prototypes: Create low-fidelity prototypes (e.g., sketches and wireframes) to quickly test and iterate on ideas. Then, develop high-fidelity prototypes that closely resemble the final product for more detailed testing.

Test

Usability testing and feedback loop: Conduct usability testing with real users to evaluate the effectiveness and efficiency of the prototypes. Gather user feedback and use it to make necessary adjustments and improvements in an iterative process that responds to the evolving needs of users.

Annexure B: List of literature reviewed

NAME OF PROGRAM GUIDELINE	REFERENCE
	THEMATIC AREA – RMNCH+A
My Safe Motherhood Booklet for Expecting Mothers	National Health Mission. (n.d.). My safe motherhood booklet (English). nhm.gov. in. https://nhm.gov.in.
Guidelines for Pradhan Mantri Surakshit Matritva Abhiyan	Ministry of Health and Family Welfare. (n.d.). High-risk conditions in pregnancy. mohfw.gov.in. https://mohfw.gov.in.
Ayushman Bharat: Comprehensive Primary Health Care through HWC Operational Guidelines	National Health Mission. 2018. Operational guidelines for CPHC. nhm.gov.in. https://nhm.gov.in.
Handbook for Auxiliary Nurse Midwives, Lady Health Visitors, and Staff Nurses	National Health Mission. 2010. PDF - Cover book II. nhm.gov.in. https://nhm.gov. in.
JSSK Dietary Norms Operational Guidelines	National Health Mission. (n.d.). JSSK A5. nhm.gov.in. https://nhm.gov.in.
JSY Features and FAQs	National Health Mission. (n.d.). 97827133331523438951.pdf. nhm.gov.in. https:// nhm.gov.in.
Integrated Child Development Scheme (ICDS): Child Development Manual for District-Level Functionaries	Department of Administrative Reforms & Public Grievances. 2017. ICDS. darpg. gov.in. https://darpg.gov.in.
Intensified National Iron Plus Initiative (I-NIPI) Operational Guidelines	National Health Mission. 2018. Untitled. nhm.gov.in. https://nhm.gov.in.
National Guidelines for Calcium Supplementation during Pregnancy and Lactation	National Health Mission. 2014. National guidelines for calcium supplementation during pregnancy and lactation. nhm.gov.in. https://nhm.gov.in.
Updated Guidelines for Prevention of Parent- to-Child Transmission (PPTCT) of HIV using Multi-Drug Anti-Retroviral Regimen in India	National AIDS Control Organization. 2013. National guidelines for PPTCT. naco. gov.in. https://naco.gov.in.
National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases & Stroke (NPCDCS) Operational Guidelines	Ministry of Health and Family Welfare. 2017. Operational guidelines of NPCDCS (Revised 2013-2017). mohfw.gov.in. https://mohfw.gov.in/sites/default/files/ Operational%20Guidelines%20of%20NPCDCS%20%28Revised%20-%202013- 17%29_1.pdf.
Collaborative Framework for Management of Tuberculosis in Pregnant Women	Ministry of Health and Family Welfare. 2023. MH-TB framework (Final, Feb 18). tbcindia.mohfw.gov.in. https://tbcindia.mohfw.gov.in/wp-content/ uploads/2023/05/5156619257Print-ready-version-MH-TB-Framework_Final_Feb- 18.pdf.
A Strategic Approach to RMNCH+A for Healthy Mother and Child	National Health Mission. 2013. RMNCH+A strategy. nhm.gov.in. https://nhm.gov. in/images/pdf/RMNCH+A/RMNCH+A_Strategy.pdf.
Home-Based Newborn Care Operational Guidelines	National Institute of Health and Family Welfare. 2011. Operational guidelines on home-based newborn care (HBNC). nihfw.org. https://nihfw.org.
Handbook for ASHA Facilitator and ANM/ MPW on Home-Based Newborn Care and Home-Based Care for Young Children	National Health Mission. (n.d.). Part-1 = 1-7. nhm.gov.in. https://nhm.gov.in.
Handbook for ASHA on Home-Based Care for Young Children	National Health Mission. (n.d.). Handbook for ASHA on HBYC (English). nhm.gov. in. https://nhm.gov.in.

NAME OF PROGRAM GUIDELINE	REFERENCE
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Indian Public Health Standards: Sub-District Hospitals and District Hospitals 2022 Guidelines Vol. 1	National Health Systems Resource Centre. (2022). District hospitals & sub- district hospitals: Volume 1 [PDF]. https://nhsrcindia.org/sites/default/files/ Volume%201_SDH-DH_0.pdf
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NAME OF PROGRAM GUIDELINE	REFERENCE		
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	THEMATIC AREA – Mental Health		
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Training Manual on Mental, Neurological, and Substance Use (MNS) Disorders Care for ASHA at Ayushman Bharat – Health and Wellness Centres	National Health Systems Resource Centre (NHSRC). (2022). MNS care training manual for ASHA at HWC (English). https://nhsrcindia.org/sites/default/ files/2022-05/MNS%20care%20Training%20manual%20for%20ASHA%20at%20 HWC%20%28english%29.pdf		
Training Manual on Mental, Neurological, and Substance Use (MNS) Disorders Care for Community Health Officers at Ayushman Bharat – Health and Wellness Centres	National Health Systems Resource Centre (NHSRC). (2022). MNS care training manual for CHO. https://nhsrcindia.org/sites/default/files/2022-05/MNS%20 care%20Training%20manual%20for%20CHO.pdf		
Training Manual on Mental, Neurological, and Substance Use (MNS) Disorders Care for Medical Officers at Ayushman Bharat – Health and Wellness Centres	National Health Systems Resource Centre (NHSRC). (2021). MNS care training manual for medical officers. https://nhsrcindia.org/sites/default/files/2021-12/MNS%20Care%20Training%20Manual%20for%20Medical%20Officer.pdf		

Annexure C:

Discussion points from stakeholder engagement

Digital Health Solution Developers

- It was stated that the vast expanse of information on care continuum, health care service delivery, national health programs, and protocols, among others, makes it challenging to consolidate information for digital solutions. Besides, the frequent need to collaborate with program teams becomes challenging, leading to multiple rounds of iterations and making the development process cumbersome.
- Another critical concern is ensuring the protection of sensitive health information. Moreover, navigating the complex and varying regulatory landscapes across different regions further complicates the development and deployment of digital health solutions.
- It was also highlighted that integrating new digital health applications with existing systems is a significant challenge due to differences in data formats, standards, and protocols. This lack of interoperability can impede seamless data exchange between systems, which is crucial for effective health information management.
- Finally, network connectivity is a crucial component of healthy IT infrastructure. Limited connectivity in many regions acts as a barrier to the adoption of digital solutions by health care providers and citizens, negatively impacting operational efficiency and user experience.

Health Care Seekers

- No comprehensive view of care seekers' health care data in a single space, making it difficult for them to share health data with a provider to receive customized/value-based care. Lack of data convergence sometimes leads to disparate treatment.
- Health care seekers also mentioned that while some hospitals maintain their health records in physical formats, others with digital health applications store information in digital formats. Hence, for patients, their health records are stored across offline and online modes, making it difficult to effectively share their historical health data with a future provider or self.
- Limited information on programs, provisions, and options in the health care ecosystem in a user-friendly and a single source puts care seekers at a disadvantage, leading to delayed diagnosis and treatment.
- Despite availability of digital health solutions in the market, their uptake remains low because of lack of awareness in citizens, especially in Tier 2, Tier 3 cities, and rural areas.

Health Care Service Providers

- This group highlighted that they face significant challenges in adopting and using digital health tools due to a lack of user interface design, intuitive navigation, and consideration of diverse user needs. Multiple identifiers (e.g., Benefit ID and Patient ID) across different programs and institutions create difficulties in uniquely identifying care seekers, tracking their medical history, and maintaining continuity of care. Additionally, the absence of culturally sensitive options and availability in multiple languages further hinders usage.
- Health care providers highlighted that there is insufficient capacity building and training, which often lacks context and ongoing support from technical teams after an application is rolled out. This gap deters users from addressing their concerns, leading to irregular usage. Additionally, without clear mandates for centralized data reporting, providers lack the necessary guidelines and policies to share data effectively with policymakers and researchers.
- It was also mentioned that health data for individual care seekers is not recorded in a centralized system. Lack of a robust health information management systems often results in fragmented, inefficient, or manually maintained data, leading to unusable, duplicated, and incomplete records.

Proposed solutions from stakeholder engagement

>>>	Digital Health Solution Developers	 A standardized and expert-validated document outlining the necessary data points for developing a digital solution will be helpful. A compendium containing information on relevant health themes, services, service providers, and national programs will be valuable.
>>>	Health Care Seekers	 A user-friendly tool with information on health care providers in the vicinity will help in early consultation. Information on health service delivery and national health programs will be beneficial. Orientation and awareness on how to register and use digital applications launched by the government will be useful.
>>>	Health Care Service Providers	 A centralized and health domain-agnostic system along with an easy-to-use tool should be developed to record all care seeker-related data. The end-user tool should have options to use vernacular language. Unique identifiers for care seekers should be developed so that data from patients' care-seeking journeys can be captured in one place, in a digital format. Regular training and capacity building of service providers should be undertaken on these digital tools, and updated job aids should be shared to troubleshoot if any issue arises.

Annexure D:

List of stakeholders consulted for feedback and validation

S. NO.	DOMAIN	ORGANIZATION/EXPERTS
1	Health Systems	National Health Systems Resource Centre (NHSRC), Uttar Pradesh– Technical support unit (UP-TSU), PATH, Uttar Pradesh–Behavioural Insights Unit (UP BIU)
2	RMNCH+A	UP-TSU, PATH, Eangender Health Bill and Melinda Gates Foundation
3	Immunization	UP-TSU
4	NCD and Mental health	Ex-NHSRC Expert
5	Digital Health	UP-TSU, Piramal Foundation, Everwell, Khushi baby
v	HCD	Dalberg, PATH, BMGF

A panel of experts from the aforementioned organizations was consulted to provide feedback and validate the proposed framework and accompanying Excel compendium. Their technical expertise in health thematic areas enabled a thorough evaluation of the framework's structure, facets, and relationships. They also assessed the accuracy of the service delivery mapping.

Based on the expert feedback, the project team made necessary modifications to the Excel-based mapping. It was emphasized that ongoing reference to updated guidelines is crucial to ensure the framework and compendium remain relevant to the evolving landscape of public health care service delivery.

Although the information in the compendium is publicly accessible via national guidelines, experts agreed that this synthesized version offers significant value. Unlike other existing platforms, the Excel compendium provides a comprehensive overview of all relevant guidelines across health system thematic areas. Its user-friendly format, designed for digital solution developers, and the inclusion of a plug-and-play tool enhance its utility for both public health administrators and implementers.

Annexure E:

Use cases of the framework





Annexure F:

Technical specifications for the end-user tool

The end user tool was designed and built with the support of a technical agency specialized in creating digital applications. The reference used for the tool was the <u>LIST Visualizer</u> with the desired functionality which ensures that there are one to many relationship between the elements and a pivot against each is possible.

Key features of the tool include :

- Dynamic visualization: Integrates framework facets into a schema diagram, visually simplifying complex healthcare workflows.
- **One-to-one and one-to-many relationships:** Connects single elements to single and multiple elements of different facets for comprehensive data mapping.
- Pivot functionality: Enables dynamic forward and backward linkages for seamless navigation across selected elements.
- Filtering and refresh functionality: Refine searches by filtering across framework facets and reset to default state using the refresh.
- Schema Download: Export all or filtered data in Excel or image formats.
- Public Access: Available in the public domain for unrestricted use.

To access the user guide and learn how to navigate the tool, you can either download it from the home page of the user tool's URL or scan the QR code. To access the User Guide, pelase scan the QR Code





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